

**REPORT OF THE
INTERNATIONAL
PACIFIC HALIBUT COMMISSION**

**APPOINTED UNDER THE CONVENTION BETWEEN CANADA AND THE
UNITED STATES OF AMERICA FOR THE PRESERVATION OF THE
NORTHERN PACIFIC HALIBUT FISHERY**

NUMBER 38

**REGULATION AND INVESTIGATION
OF THE PACIFIC HALIBUT
FISHERY IN 1964**

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FOREWORD

The terms of the 1953 Convention between the United States and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea provide that the International Pacific Halibut Commission shall publish a report of its activities and investigations from time to time.

The present report, the thirty-eighth published by the Commission, is the eighteenth of a series of annual reports that was begun in 1947 to provide a summary of the Commission's activities and results of its investigations during the year.

Those desiring additional background information on the Commission's activities are referred to earlier reports.

REGULATION AND INVESTIGATION OF THE PACIFIC
HALIBUT FISHERY IN 1964

by

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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INTRODUCTION

The halibut fishery of Canada and the United States in the northern Pacific Ocean and Bering Sea has been subject to scientific study and regulation for forty years. These activities have been carried out by the International Pacific Halibut Commission under authority of the 1953 Convention and by the precedent International Fisheries Commission under Conventions signed in 1923, 1930 and 1937.

Under the first Convention, which was signed March 2, 1923 and ratified October 21, 1924, the responsibilities of the Commission were largely directed to investigation of the conditions of the fishery for the purpose of recommending measures for its rehabilitation. The Convention did provide for a winter closed season aimed at reducing fishing intensity on spawning concentrations of halibut.

The subsequent Conventions of 1930, 1937 and 1953 provided for the division of the coast into areas, the control of the amount of fishing by setting annual catch limits or by adjusting the length of the closed season in any area, and the placing of limits on the size of the fish to be retained by the fishery. The current 1953 Convention, which provided the present name for the Commission, specifically charges it with developing the stocks of Pacific halibut to levels which will permit maximum sustained yield and with maintaining the stocks at those levels.

ACTIVITIES OF THE COMMISSION

During 1964 the Commission continued its program of statistical and biological observations which provide the basis for the regulation of the fishery according to scientific principles as required by the 1953 Convention.

United States Members in 1964 were: Mr. Harold E. Crowther, Washington, D.C., Chairman; Mr. Mattias Madsen, Seattle, Washington, to May 15; and Mr. William A. Bates, Ketchikan, Alaska, to October 29. Canadian Members were: Dr. William M. Sprules, Ottawa, Ontario, Vice-Chairman; Mr. Martin K. Eriksen, Prince Rupert, British Columbia; Mr. Richard Nelson, Vancouver, British Columbia, to October 31; and Mr. Francis W. Millerd, Vancouver, British Columbia, from November 19. The Chairmanship and Vice-chairmanship alternate between the two countries in successive years.

Mr. William A. Bates, United States Member, passed away in Seattle, Washington on October 29. Mr. Bates was well acquainted with the Alaska fishing industry and had taken a leading part in the industrial development of Southeastern Alaska. He was Chairman of the Board of the National Bank of Alaska having been associated with banking in Alaska for the past 42 years.

The Commission held its regular annual meeting in Seattle, Washington, at its office and laboratory headquarters, from January 28 to 30, 1964. During the sessions it examined the results of its investigations and regulations during 1963, dealt with administrative and budgetary matters, conferred with industry representatives regarding the regulation of the fishery, and adopted regulations for 1964.

On the morning of January 28 the Commission met briefly to discuss a number of matters related to the agenda of the meeting. Later in the morning and in the afternoon it met with representatives of all branches of the industry and other interested individuals. At this session the Commission's staff presented results of scientific investigations in 1963 and reviewed the status of the stocks and of the fishery. Proposals regarding the regulation of the fishery in 1964 were discussed with the Commission and the assembled representatives of the industry.

On January 29 the Commission held sessions with the staff to deal with administrative, budgetary and other matters related to the program of research and

regulation of the fishery. The Commission met jointly on January 30 with the Conference Board, consisting of representatives of the fishermen and vessel owners, and with spokesmen for dealers from all sections of the coast to further discuss proposals regarding the regulations for 1964.

During the fifth and last session of the meeting on January 30 the Commission considered proposals of the staff and industry regarding regulation and then adopted regulations for 1964. A summary of the measures being recommended for approval by the two governments, as required under the Convention, was immediately released for the information of the industry and the public.

A special meeting of the Commission was held in Seattle on June 4 to examine the condition of the halibut stocks on various sections of the Pacific Coast and particularly those in Area 3B North Triangle where the fleets had experienced very poor fishing in the spring. The total catch by Canada, United States and Japan from the latter area by the end of May was only 1,790,000 pounds, considerably below the 6,393,340 pound catch limit set for the area by the International North Pacific Fisheries Commission.

Conditions in Bering Sea were reviewed with the staff and with representatives of the halibut industry from Canada and the United States. Since fishing on the edge grounds in Area 3B North Triangle by the fleets of the three countries appeared to have largely terminated for the year, it was evident that any immediate action was unnecessary unless conditions should change. However, in view of the sharp decline that had occurred in the stocks, the Commission advised the Governments of Canada and the United States that unless there was marked improvement it might become necessary to recommend the closure of Area 3B North Triangle in 1965.

A conference of members of the Commission was held in the Commission's laboratory on October 30 to again review with the staff the stock conditions in Bering Sea. A formal meeting of the Commission at this particular time was not possible due to the sudden passing of Mr. William A. Bates which reduced the United States representation to only one member since a successor to Mr. Mattias Madsen, resigned, had not yet been appointed. Proposals for regulation of the fishery in Bering Sea in 1965 were considered, including those received from vessel owners' and fishermen's organizations immediately concerned with the fishery in that region.

Further analysis of the data on the fishery and on the stocks in the area had indicated that a moderate removal from Area 3B North Triangle was possible in 1965. While the stocks were greatly reduced, some replenishment from immigration and normal recruitment and growth was expected by 1965, particularly in view of the sharp reduction in removals in 1964. Also, it was evident that on the edge grounds west of the Pribilof Islands the supply of halibut had not undergone the same degree of decline as in Area 3B North Triangle.

As a result of the conference the Commission announced that it was considering recommending in first order of priority that Area 3B North open at 1500 hours March 25, 1965 and close at 1800 hours October 15; and that Area 3B North Triangle open at 1500 hours April 6 and close at 1800 hours April 11. Such a disposition of fishing would permit a conservative cropping of the replenished stocks and would also provide an adequate evaluation of the condition of the resource in Area 3B North Triangle. The sequence of opening dates of the two areas would provide a feasible operation for the fleets despite the condition of the stocks in Area 3B North Triangle.

It was also announced that in the event such a limited fishery could not be provided in Area 3B North Triangle, the Commission had under consideration

recommending that Area 3B North would open and close as above but that Area 3B North Triangle would remain closed in 1965. While the latter measure would be drastic, the need for rebuilding the stocks in that region was considered urgent.

During the Area 3A fishing season the Commission determined the date upon which it deemed the catch limit of that area would be attained, announced that date in advance and subsequently closed the area. Catch quotas were not attained during the fishing seasons in Areas 2 and 3B North Triangle, and the areas were closed on the statutory dates as provided in the regulations. It was deemed that the catch limit in Area 3B South would be attained on the statutory date of October 15 as provided by the regulations, and the area closed accordingly.

During the year the Commission published its regular annual report "Regulation and Investigation of the Pacific Halibut Fishery in 1963", a scientific report on the "Investigation, Utilization and Regulation of the Halibut in Southeastern Bering Sea", and a data report on "Catch Records of a Trawl Survey Conducted by the International Pacific Halibut Commission Between Unimak Pass and Cape Spencer, Alaska from May 1961 to April 1963." In addition various technical manuscript reports were prepared to provide the Governments of Canada and the United States with background information, chiefly with respect to matters under consideration by the International North Pacific Fisheries Commission.

REGULATION IN 1964

The Pacific Halibut Fishery Regulations, adopted by the Commission for 1964, were approved by the Governor General of Canada in Council on March 12 and by the President of the United States of America on March 18 at which time they became effective. These regulations, as was the case in 1963, also implemented on behalf of Canada and the United States the conservation measures recommended by the International North Pacific Fisheries Commission in eastern Bering Sea.

Regulatory Areas

Significant changes in the regulations effected in 1964 included designating September 15 as the statutory closing date for Areas 1 and 2; the assigning of a catch limit for Area 3B South; and a sharp reduction in catch limit in Area 3B North Triangle from 11,000,000 pounds in 1963 to 6,393,340 pounds in 1964 as recommended by the International North Pacific Fisheries Commission.

The regulatory areas in 1964, shown in Figure 1, were as follows: Area 1—the convention waters south of Willapa Bay, Washington; Area 2—the waters off northern Washington, British Columbia and Southeastern Alaska between Willapa Bay and Cape Spencer, Alaska; Area 3A—the waters off Alaska between Cape Spencer and Kupreanof Point near the Shumagin Islands; Area 3B South—the waters south of the Alaska Peninsula and the Aleutian Islands west of Kupreanof Point; Area 3B North Triangle—the waters between the Pribilof Islands and Unimak Pass and along the Aleutian Islands chain from Unimak Island to the 170° West longitude line; and Area 3B North—the waters of Bering Sea, not including those in Area 3B North Triangle.

The above divisions of the convention waters are designed to provide practical management divisions. These may be opened or closed to fishing at different times in order to secure the amount of fishing appropriate to the productivity of the various grounds, and with recognition of the seasonal differences in availability of halibut on various sections of the coast. The divisions should not be regarded as necessarily defining separate biological populations.

Catch Limits

Catch limits of 25,000,000, 34,000,000, 4,000,000 and 6,393,340 pounds respectively were assigned to Areas 2, 3A, 3B South and 3B North Triangle during 1964,

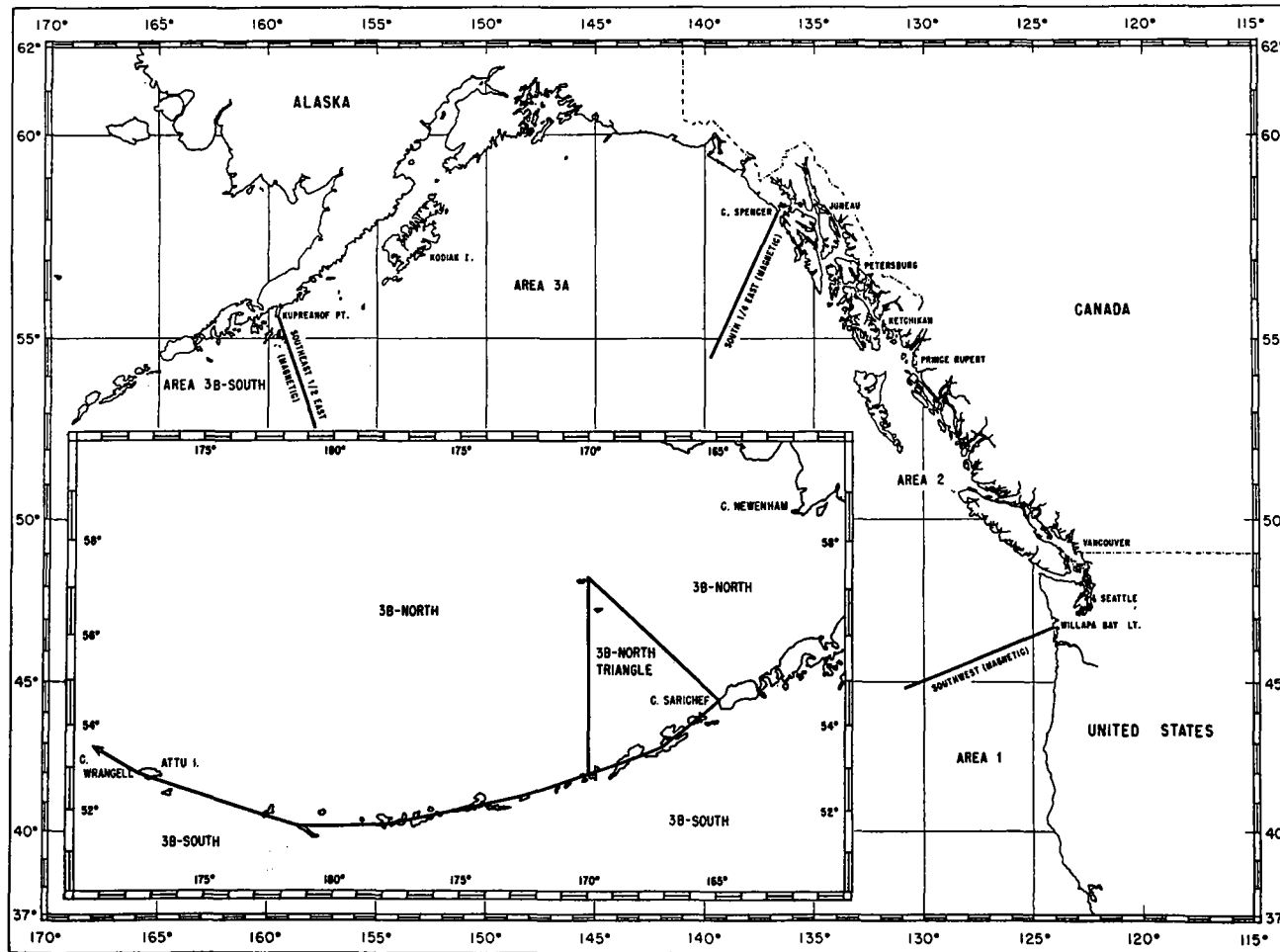


Figure 1. Pacific Coast of North America showing regulatory areas defined by the International Pacific Halibut Commission in 1964.

the latter limit as recommended by the International North Pacific Fisheries Commission as the three-nation total for Canada, United States and Japan. There was no catch limit in Area 1 or in Area 3B North. The Area 2 limit was reduced 3 million pounds from 1963; the Area 3A limit was the same as in 1963; and the Area 3B South limit was newly assigned.

Since the probable fishing power which might be directed into Area 3B South following the initial fishing in Area 3B North Triangle was no longer as predictable as in previous years, the Commission deemed it advisable to assign a catch limit to Area 3B South to assure that an undue amount of fishing was not applied to the stock components within the area. This application of a catch limit is another example of the flexibility in the management procedures of the Commission required to meet the changing conditions within the fishery. The 4,000,000 pound limit imposed continues the level of removal of previous years when the catch was controlled by the length and timing of the season, and when combined with the Area 3A limit provides for a removal of 38,000,000 pounds from the grounds west of Cape Spencer which is the current best estimate of the maximum sustainable yield for this region.

Lengths of Seasons

Areas 1 and 2, which opened on May 1, terminated on September 15, the statutory closing date, since the catch limit for Area 2 was not attained earlier. This provided a 137-day season. The 110-day season in Area 3A, which also commenced on May 1, terminated on August 19 with announcement on August 2 to provide the customary 18 days notice of closure. The 204-day fishing season in Areas 3B North and 3B North Triangle opened on March 25 and terminated on October 15, the same as in 1963. Area 3B South opened on April 6 and closed October 15 after 192 days of fishing, 13 days more than in 1963. The opening dates of all areas and closing dates of those areas without catch limits are announced in regulations published prior to the fishing season.

STATISTICS OF THE FISHERY

Landings by Regulatory Areas

Landings of halibut in thousands of pounds for groups of regulatory areas for the years 1962 to 1964 are shown in the following table with comparable landings for 1931, the year immediately preceding the commencement of regulation by the Commission. Since Areas 3A, 3B South, 3B North and 3B North Triangle are management areas only and not indicative of stock separations, the landings from these areas are combined in the table. Estimates of the poundage taken in contravention of the regulations are included in the totals for each section of the coast. All 1964 figures in the report are preliminary.

United States and Canadian Catches by Regulatory Areas
in Thousands of Pounds

Year	Area 1* U.S.	Area 2			Areas 3A, 3B North, 3B North Triangle and 3B South U.S. Canada Total**			All Areas		
		U.S.	Canada	Total	U.S.	Canada	Total**	U.S.	Canada	Total
1931	1,121	14,609	7,018	21,627	20,907	765	21,672	36,637	7,783	44,420
1962	312	14,480	14,183	28,663	25,654	20,490	46,144	40,446	34,673	75,119
1963	205	11,689	14,462	26,151	22,396	22,671	45,067	34,290	37,133	71,423
1964	139	8,223	11,461	19,684	18,024	22,154	40,178	26,386	33,615	60,001

* Catches from Area 1 are shown separately only to indicate the relatively small production from these grounds at the southern limit of the species.

** Does not include 3,600,000 pounds and 261,000 pounds taken by Japan in Area 3B North Triangle in 1963 and 1964 respectively or their halibut catches in the remainder of Bering Sea in any year.

Area 1

In Area 1 the total 1964 catch was only 139,000 pounds. At present there is little fishing effort directed toward halibut in this area, and much of the catch is taken incidentally by vessels fishing for other species. The region encompasses the southern commercial limit of the Pacific halibut in the eastern Pacific Ocean, and tagging and other studies indicate that the halibut in the region are biologically inseparable from those on the grounds to the north. It has been identified as a separate area for enforcement reasons which presently have largely disappeared.

Area 2

In Area 2 the 1964 total catch was 19,684,000 pounds, about 5.3 million pounds below the catch limit. This is the second consecutive year in which the catch has fallen below the prescribed catch limit. Foremost among the factors responsible was a substantial reduction in the size of the Area 2 fleet as a whole, and particularly in Southeastern Alaska where 45 percent of the vessels that engaged in the 1963 halibut fishery did not fish halibut in 1964. The total Area 2 regular fleet was reduced from 353 vessels in 1963 to 241 vessels in 1964, nearly a 30 percent reduction. The sharp reduction in fleet resulted from continued low availability of halibut on most grounds, the reduced halibut prices in the previous year and the greater relative attractiveness of other fisheries.

A second factor was the reduction in the length of the fishing season when the statutory closing date was moved from November 15 to September 15. The foregoing factors, coupled with a continued low level in the catch per unit effort, were the primary conditions causing the reduced catch in Area 2 in 1964.

Area 3A

In Area 3A the total 1964 catch was 33,169,000 pounds. The deficit from the 34.0-million-pound catch limit resulted mainly from severe weather at the end of the season, and the failure of a few vessels to carry out their intentions of fishing their final trip in the area and diverting to Area 3B South.

Area 3B South

In Area 3B South the total 1964 catch was 4,687,000 pounds. The combined Area 3A and Area 3B South catch of 37.9 million pounds was slightly less than 38 million pounds, which is the current best estimate of maximum sustainable yield for the two regulatory areas combined.

Area 3B North Triangle

In Area 3B North Triangle the 1964 total catch was 1,884,000 pounds taken by the United States and Canadian fleets, and an additional 261,000 pounds taken by the Japanese fleet which has participated in this fishery since 1963 under the terms of the International North Pacific Fisheries Convention. This three-nation catch of 2,145,000 pounds was below the 6.4-million-pound catch limit recommended by the International North Pacific Fisheries Commission for the area. The low catch can be attributed to the low stock levels in the area resulting from excessive removals by the three nations in 1963, and prior removals by the United States and Canadian fleets, particularly the large catch in 1962.

The 1964 catch from Area 3B North Triangle was taken primarily during a short and intensive fishery on the "edge" grounds during the last week in March and the first week in April. In addition a quarter of a million pounds were taken near the Fox Islands in the late summer and fall, the normal period of best fishing for these grounds.

Area 3B North

In Area 3B North, which comprises all of Bering Sea exclusive of Area 3B North Triangle, the total Canadian and United States catch in 1964 was 438,000 pounds, most of which was taken along the "edge" grounds west of the Pribilof Islands. There is no catch limit for this regulatory area and the 1964 total was below the 870,000 pounds taken by Canada and United States in 1963.

Landings by Ports

The distribution of halibut landings in thousands of pounds from all areas is shown in the following table according to regions and ports or groups of ports for 1964 with comparable data for 1962 and 1963.

United States and Canadian Landings by Regions and Ports in Thousands of Pounds

Ports	1962			1963			1964		
	U.S.	Canada	Total	U.S.	Canada	Total	U.S.	Canada	Total
California and Oregon	392	—	392	228	—	228	126	—	126
Seattle	10,089	877	10,966	10,596	1,376	11,972	7,951	1,226	9,177
Bellingham	2,065	3,256	5,321	769	2,916	3,685	981	1,692	2,673
Other Wash.	237	—	237	226	—	226	264	—	264
Vancouver, B.C.	—	4,527	4,527	—	5,783	5,783	—	5,649	5,649
Vancouver I.	—	1,354	1,354	—	1,557	1,557	—	851	851
Prince Rupert	644	17,142	17,786	733	17,248	17,981	555	18,252	18,807
Other B.C.	—	1,794	1,794	—	1,222	1,222	—	875	875
Ketchikan	10,101	705	10,806	6,838	1,170	8,008	6,212	929	7,141
Other	—	—	—	—	—	—	—	—	—
S.E. Alaska	11,638	895	12,533	8,960	651	9,611	6,999	497	7,496
Central Alaska	5,280	4,123	9,403	5,940	5,210	11,150	3,298	3,644	6,942
TOTALS	40,446	34,673	75,119	34,290	37,133	71,423	26,386	33,615	60,001

With the exception of Prince Rupert, landings on all sections of the coast were lower than in 1963 reflecting the 11.4-million-pound reduction in the total catch of halibut taken during the year.

Landings in California and Oregon were at their lowest point in recent years. Landings in Washington ports were also below last year reflecting the reduced production from both Bering Sea and Area 2.

Vancouver landings were down slightly from 1963, but were still substantially above the 1962 total. Prince Rupert showed a notable increase in receipts of almost one million pounds, and accounted for over 30 percent of the total 1964 Pacific Coast production.

Landings in Southeastern Alaska ports continued to decline for the second successive year, reflecting the substantial reduction of fishing effort and catch on this section of the coast. Central Alaska landings were lower by 4.2 million pounds from the 1963 high, most of the decline being attributable to the reduced production in Bering Sea.

Catch Per Unit of Fishing Effort

In Area 2 there was a slight improvement in the catch per unit effort, terminating a downward trend that had prevailed since 1961.

North of Dixon Entrance in Area 2, both the inside and outside grounds of Southeastern Alaska showed an increase in the catch per unit effort in response to the substantial reduction that has occurred in fishing effort and catch in that region since 1962.

South of Dixon Entrance off the coast of British Columbia the trends in catch per unit effort were varied. Northern and middle Hecate Strait and Cape Scott grounds continued a downward trend. However, in lower Hecate Strait and on Goose Islands grounds there was a slight improvement, and off the northwestern coast of Queen Charlotte Islands there was a substantial rise in the catch per unit effort. The increases on some grounds off British Columbia tended to offset the declines on others resulting in an overall catch per unit effort for that region close to the level prevailing in 1963.

In Area 3A the catch per unit effort continued to decline slightly but at a lesser rate than in previous years. There was considerable variation within the area with a slight improvement east of Cape St. Elias and a continuing decline in the westward sections of Area 3A.

In Area 3B South the catch per unit has continued to decline, reflecting the high removals taken from this region annually since 1959.

In Bering Sea the catch per unit effort in Area 3B North Triangle declined sharply and at an accelerated rate, and for the second year failed to show any early-season recovery from the levels attained at the end of the previous season. There is little doubt that the removals from this relatively small halibut fishing area have been substantially in excess of the sustainable productivity of the area and will probably require a sharp reduction of fishing pressure to restore the supply of halibut there to optimum levels.

In the remainder of Bering Sea defined as Area 3B North, including the edge west of the Pribilof Islands, the catch per unit effort also declined despite only modest removals and an age composition that does not yet indicate an overfished condition. However, the catch per unit effort is still much higher than on the edge in Area 3B North Triangle but the grounds do not appear to possess the production potentials as prevailed in earlier years in the latter region.

COMPOSITION OF THE CATCHES

Continuous evaluation of the influences of fishing and natural factors upon the halibut population and the effectiveness of current regulations is required in order that removals from each stock may be maintained at the optimum level. Studies of the age and sex composition of the catches from the various grounds provide information regarding the number of spawners and recruits and their rates of growth and mortality, essential to this evaluation.

Data for determination of the composition of the stocks consist chiefly of representative samples of lengths and associated samples of otoliths for age assessment collected from the commercial landings. Also, since the sex of individual halibut is not identifiable from the eviscerated fish as landed, such market samples are supplemented by those taken at sea from commercial as well as research vessels where observation on sex and stage of maturity of individuals can be made.

In 1964 sampling of the commercial landings was continued on a regular basis at Seattle, Prince Rupert and Petersburg, and occasionally at Vancouver, Ketchikan, Kodiak and Sand Point. A record total of 313 commercial trips were sampled, providing over 95,000 measurements and data for age determination. In

addition 26,000 measurements identified by sex were obtained from vessels chartered for tagging or for recruitment studies. Commercial trips sampled included 18 setline and 27 trawler trips sampled at sea, 15 of the latter being made in Area 1 off northern California to investigate the trawl capture of halibut in that region and to tag halibut caught inadvertently by that fishery.

The number of trips sampled, whether at sea or ashore, is shown by area of origin in the following table.

Summary of Catch Sampling in 1964 showing Number of Trips according to Area of Origin

Area of Origin	Number of Trips		
	Port Sampling	Sea Sampling*	Total
Northern Calif. — Southern Oregon	—	15	15
Cape Flattery to Cape Scott	3	3	6
Cape Scott to Goose Is.	23	10	33
Queen Charlotte Is. and Dixon Entrance	12	—	12
Hecate Strait	27	3	30
Southeastern Alaska	60	1	61
Totals South of Cape Spencer	125	32	157
Cape Spencer — Cape Cleare	49	—	49
Cook Inlet — Shelikof St.	8	—	8
Portlock-Albatross Banks	52	6	58
Trinity Is. — Chirikof Is.	13	4	17
Shumagin Is. & West (3BS)	9	1**	10
Bering Sea	12	2	14
Total West of Cape Spencer	143	13	156
Totals Pacific Coast	268	46	313

* In Area 2 except for 5 setline trips in the Cape-Scott-Goose Is. region the samples were taken on trawlers.

** Sample obtained by United States observer on Japanese trawler.

In Area 2 age composition studies of setline landings indicate that the permitted annual catches over the near term should be held at very conservative levels. The catches from important fishing grounds in all sections continue to be unduly dependent upon young fish, 10 years of age (the 1954 year class) and younger. In this respect present conditions parallel those prevailing in the 1948-1951 period.

On Goose Islands grounds and throughout Hecate Strait the 1951 and 1954 year classes, long the main supports of the fishery there, have declined markedly. Only one younger class, that of 1957, has shown a relatively strong entry into the fishery but it was also at a lower level in 1964 as seven-year-olds than in 1963 as six-year-olds.

In Southeastern Alaska the declines noted in most older age groups in recent years appear to have levelled off, but the young classes newly entering in Hecate Strait have yet to make an appearance in Southeastern Alaska. This lag in recruitment of new classes between their first appearance in sections of Hecate Strait and on grounds both inside and outside the archipelago of Southeastern Alaska has been observed many times in the past and appears to be typical of the region.

As the season progressed in 1964 catches from most grounds in Area 2 showed a rise in availability of all ages with the greatest increases occurring among young fish.

West of Cape Spencer, where samples from Portlock and Albatross Banks and from grounds off the Shumagin Islands and Davidson Bank have displayed similar changes in composition, the decline in older fish noted for several years continued in 1964. However, the modal groups most important to the commercial fishery, ages 9 to 13, including the 1954 and 1951 year classes, remained strong. In addition, the 1955 year class has made a strong latent appearance as nine-year-olds and is the dominant group on most grounds west of Cape Spencer. The 1957 year class, which appeared strongly in Hecate Strait, also made a prominent appearance in Area 3B South especially in late-season catches.

In Area 3B North Triangle the failure of the fishery on the Polaris and Clipper grounds in 1964 can be partly accounted for in the reduced availability of older year classes which have been contributing heavily to catches in recent years and to the lack of any strong recruitment of younger classes. On the Polaris ground the relative abundance of halibut aged 12 and older was 43 percent lower in 1964 than in 1963, and the 1951 year class, which had been especially important to catches from all grounds in southeastern Bering Sea for the past five years alone declined 66 percent in the same period.

Younger age classes in Area 3B North Triangle failed to show the usual increased recruitment with age. The catch per unit fishing effort of halibut under age 12 declined over 50 percent from 1963 to 1964. In this group of young fish the 1954 class, which has shown strong entry on most grounds in Bering Sea and which was especially strong in 1963 as nine-year-olds, not only failed to show continued recruitment in 1964 but declined prematurely from 14 fish caught per ten units of fishing effort in 1963 to 8 fish in 1964.

The decline in abundance of older fish on Polaris ground continues the trend noted since the establishment of a United States and Canadian setline fishery in the area. The rapid decline of the younger age classes between 1963 and 1964 is attributable primarily to the 3.6-million-pound Japanese removal in 1963, the composition of which has been shown to have been preponderantly of fish of small size (INPFC Doc. 662). Although the effects of the massive trawl fisheries in eastern Bering Sea upon young halibut there cannot be ruled out, the full impact of such possible mortalities is not yet due in force. The threat remains imminent, particularly since meal-fish trawling, which can be most destructive of small halibut, was expanded on the flats in 1964 after a substantial reduction in effort in 1962 and 1963.

Catches from other grounds in Bering Sea continue to contain larger proportions of older fish than from the Polaris and Clipper grounds, especially those from the edge of the shelf west of the Pribilof Islands. All ages were well represented in the summer catches in shoal water close to the Pribilof, St. Matthew and Nunivak Islands, and in the fall catches off the Fox Islands. However, occasional probes by research vessels of the Commission throughout the summer and fall showed no improvement in composition on the Polaris ground.

Seasonally, all grounds along the edge of the continental shelf west of Unimak Pass continued to show a decline in availability of halibut from spring to summer suggesting a dispersion of fish, probably to the flats of Bering Sea. Such a seasonal movement of fish from deep to shoal water is to be expected from experience all along the Pacific coast. However, setline halibut fishing becomes relatively uneconomical when the fish are dispersed on the vast area of the Bering Sea flats in contrast to the summer fishery on grounds in the Gulf of Alaska.

While tagging in Bering Sea in January, a concentration of halibut which had recently spawned was found on the Polaris ground. Forty-six percent of the catch was of fish age 12 and older, 50 percent of which were mature females. In the com-

mercial fishery in March and early April such spawning fish appeared to have dispersed and the catches contained only 30 percent fish age 12 and older of which less than one-third were mature females.

TAGGING EXPERIMENTS

Tagging experiments provide information regarding the migration of halibut between the various fishing grounds and the fishing and natural mortality rates to which they are exposed. Such knowledge is essential if the Pacific halibut fishery is to be regulated on a scientific basis as required by the Convention.

In 1964 a total of 13,521 halibut were tagged from Cape Mendocino, California to Bering Sea. This is the greatest number of halibut tagged during a single year in the 40-year history of the Commission, eclipsing the previous record operation in 1951 when 11,130 individuals were tagged. A summary of tagging from vessels chartered by the Commission is shown in the following table.

Chartered Vessel	Operation	Region of Tagging	Number Tagged
SEATTLE	Winter Setline	Area 3B South and Bering Sea	1,271
ECLIPSE	Summer Setline-Grid	Shelikof Strait to Shumagin Islands	4,818
ECLIPSE	Summer Setline	Bering Sea	861
PACIFIC	Summer-Fall Setline	Bering Sea	2,331
MORNING STAR	Recruitment Studies	Sitka to Chirikof Island	3,455
TOTAL			12,736

An additional 785 halibut were tagged between Cape Mendocino, California and northern Hecate Strait by Commission personnel from the catches of halibut taken incidentally to commercial trawling by the United States and Canadian vessels ANNA W, NEW ST. JOSEPH, ADMIRAL KING, CITY OF EUREKA, MINEO BROS., SAN VITO, GEORGENE, JO-MARC, RENOWN and SEA PRINCE.

The halibut vessel SEATTLE was chartered for a 60-day period from early January to early March completing the second phase of a tagging operation commenced in November 1963. These winter tagging operations will provide information regarding the relationship of spawning halibut in eastern Bering Sea with halibut on grounds in western Bering Sea and on grounds south of the Alaska Peninsula. In November the mature females on the edge in Bering Sea showed no evidence of spawning but by January some were observed to have recently spawned. Similar developments were observed in the halibut on grounds south of the Alaska Peninsula particularly in Shumagin Gully.

The second stage of a tagging program by setline vessels on a predetermined grid of stations was carried out by the chartered halibut vessel ECLIPSE during a period of 112 days from the first of May to mid-August. The area of operation included Shelikof Strait and the waters between Trinity and Shumagin Islands. The grid distribution of fishing and tagging was designed to assure, insofar as possible, that the catch and proportion tagged will be representative of the total population in the area. Such a representation is important in attempting to resolve the differences between mortality rates for this region as estimated from tagging data and those estimated by other means.

The chartered setline vessels PACIFIC and ECLIPSE were operated in Bering Sea for periods of 112 and 28 days respectively during July to November to tag

Summary of 1964 Tag Returns from 1961-1963 Tagging Experiments

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Year and Location	Month of Experiment	Number Tagged	Setline & Troll	Recoveries By Type Of Gear		Total Recoveries
				Other Gear*		
SOUTH OF CAPE SPENCER						
1961 Experiments						
Icy Strait	August	57	—	—	—	—
Cape Flattery	April	2	—	—	—	—
1962 Experiments						
West Coast Vancouver I.	June-Sept.	237	1	—	—	1
Cape Scott	June-Aug.	332	3	5	—	8
Goose Is.	June-Aug.	214	8	—	—	8
Horseshoe	July	58	—	1	—	1
Icy Strait	Oct.	4	—	—	—	—
1963 Experiments						
Cape Scott-Goose Is.	May-Sept.	289	31	4	—	35
West Coast Vancouver I.	Aug.-Sept.	21	1	1	—	2
Southeast Alaska	July	250	1	1	—	2
WEST OF CAPE SPENCER						
1961 Experiments						
Unimak I.-Trinity Is.	May-Nov.	2,886	13	1	—	14
Kodiak I.	May-Nov.	2,373	3	—	—	3
Cape Cleare-Cape St. Elias	Aug.-Oct.	640	1	—	—	1
Cape St. Elias-Cape Spencer	June-Sept.	601	5	—	—	5
Bering Sea	July	116	—	—	—	—
1962 Experiments						
Unimak Pass-Trinity Is.	Feb.-April	1,277	—	—	—	—
Kodiak I.	Feb.-Oct.	1,686	10	—	—	10
Cape Cleare-Cape St. Elias	May-Oct.	1,800	6	—	—	6
Cape St. Elias-Cape Spencer	June-Dec.	298	2	—	—	2
1963 Experiments						
Shumagin Is.-Unalaska I.	Aug.-Dec.	391	7	—	—	7
Cape Spencer-Cape Cleare	Jan.-July	566	1	1	—	2
Cape Cleare-Chirikof I.	Feb.-Aug.	4,046	103	2	—	105
Bering Sea	May-Nov.	2,457	14	—	—	14

* Other trawl, king crab pots and unknown.

REGULATION AND INVESTIGATION OF

halibut on the edge west of the Pribilof Islands particularly between 175° West longitude and 180°. An additional objective was the tagging of halibut on grounds along the Aleutian Chain and on Bowers Bank.

Recaptures of 478 tags were reported in 1964 including four recoveries by Japanese fishing vessels and five that had been made in previous years but not hitherto reported. Seven tags released by Japanese research vessels and recaptured in 1964 by Canadian and United States vessels were forwarded to the Fisheries Agency of Japan. Recoveries of tagged halibut during 1964 from experiments in 1961, 1962 and 1963 are summarized in the table on page 16.

Two of the 148 fish tagged in Area 1 off southern Oregon and northern California between May and July 1964 were recovered off the northern end of Vancouver Island in October and November by two vessels fishing for blackcod. A greater importance is attached to these two recoveries by setline vessels within the year of release than might otherwise be the case in view of the small number of individuals tagged and the short interval of time during which recoveries were possible. Also, they represent the first direct indication of migration from Area 1 into Area 2.

RECRUITMENT STUDIES

During the past decade the Commission has been studying the distribution of young halibut off the coasts of British Columbia and Alaska between Queen Charlotte Sound and the Shumagin Islands. The age groups sampled consisted mainly of fish one through four years of age with some individuals less than one year and a few more than five years being taken.

Initially the work was confined to inshore grounds and was designed to relate the apparent year-class abundance to subsequent recruitment into the commercial setline fishery. The expansion of foreign trawling into the Gulf of Alaska being imminent, investigations were greatly expanded between 1961 and 1963 with the aid of special funds made available by the two governments. A comprehensive trawl survey of the availability of halibut and other demersal species to trawl gear was conducted between Unimak Pass and Cape Spencer, Alaska. Approximately 1,560 stations were occupied on a predetermined pattern over the 65,000 square miles of shelf area from May 1961 to April 1963. This survey revealed a widespread distribution of young halibut over the entire shelf area.

In view of these developments an increasing share of the sampling of young fish was directed during the past three years to some of the offshore grounds between Cape Clear and the Shumagin Islands in an attempt to provide some indications of the possible impact of foreign trawling upon the stocks of young halibut in the Gulf of Alaska.

In 1964 the trawler *MORNING STAR* was chartered for 75 days from July 1 to September 13, a period similar to that of preceding years. An otter trawl with a 60-foot groundline and 1 $\frac{1}{4}$ -inch codend mesh was used to sample the inshore stations while a trawl with a 90-foot groundline and 3 $\frac{1}{2}$ -inch codend mesh was used at the offshore stations. The latter gear is the standard Pacific Coast commercial trawl and is identical to that used in the aforementioned trawl survey conducted by the Commission.

During the 1964 operations 8,679 halibut less than 66 centimeters in length were taken in depths ranging from 7 to 90 fathoms. The age composition of these halibut is summarized in the following table according to locality, both inshore and offshore. One-year-old halibut were dominant in the inshore catches while three-year-old halibut predominated in the offshore catches.

Over 3,400 young halibut, chiefly under two years of age, were tagged with plastic dart tags during 1964. Fourteen young halibut tagged in previous years were recovered in 1964. Of these, eleven had been at liberty less than a year, two less than two years and one less than four years prior to recapture. In each instance the recoveries were made near the point of tagging.

These tagging experiments were designed to provide information about the movement of young halibut between various grounds and may also indicate the level of mortality prevailing during the precommercial period of their life. With the increase in foreign trawling in the Gulf of Alaska such tagging may be useful in separating mortalities from such fishing and those due to natural causes as well as providing information on the bearing these mortalities have on the measurement of year-class strength.

The year class of 1961, which appeared in strength as two-year-olds in the inshore samples in 1963, continued equally strong as three-year-olds in the 1964 samples. They have been more abundant both as two-year-olds and as three-year-olds than were the strong 1954 and 1957 year classes at the same ages. The latter two classes entered the commercial fishery strongly as six-year-olds. The same may be expected of the 1961 brood a few years hence provided no unusual mortalities occur before they attain commercial size.

At the offshore stations no decrease in numbers of halibut has been observed over the past several years although such observations have been on a limited scale. To verify these preliminary findings and permit the separation of normal, natural fluctuations in year class strength from possible reductions caused by foreign fishing it is necessary to increase substantially the sampling program for young halibut.

Numbers of Halibut Less Than 66 Centimeters in Length
Taken in 1964 According to Locality and Age

Locality	0	1	2	3	4	5	6	7	8	9	Total
AREA 2											
Shelikof Bay (inshore)	151	376	26	314	169	40	17	—	—	—	1,093
Icy Strait (inshore)	—	—	14	300	130	57	16	19	3	1	540
AREA 3A											
Cape St. Elias (inshore)	—	348	318	189	54	12	12	—	—	—	933
Prince William Sound (inshore)	—	75	44	51	20	1	4	—	—	—	195
Copper River Flats (offshore)	—	—	—	2	11	7	14	1	—	—	35
Kodiak I. (inshore)	—	1,688	532	71	11	4	4	—	—	—	2,310
Kodiak I. (offshore)	—	7	187	987	292	66	52	47	5	—	1,643
Trinity Is. (inshore)	—	349	24	2	—	—	—	—	—	—	375
Chirikof I. (offshore)	—	—	105	676	382	163	135	87	7	—	1,555
Total	151	2,843	1,250	2,592	1,069	350	254	154	15	1	8,679
Inshore	151	2,836	958	927	384	114	53	19	3	1	5,446
Offshore	—	7	292	1,665	685	236	201	135	12	—	3,233